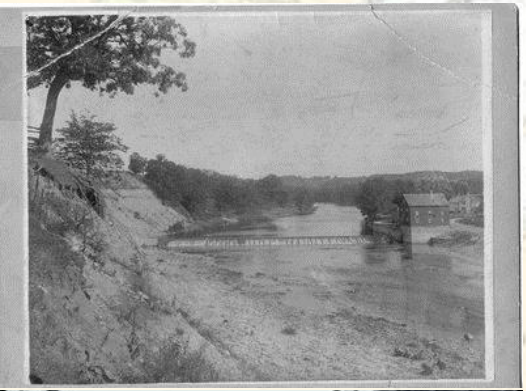
Session D1: Towards Effective, Bi-Directional Selective Fish Passage

Bi-directional, Selective Fish Passage: The Complications of Fish Passage in the Laurentian Great Lakes

Tom Pratt, Fisheries and Oceans Canada

Rob McLaughlin, University of Guelph

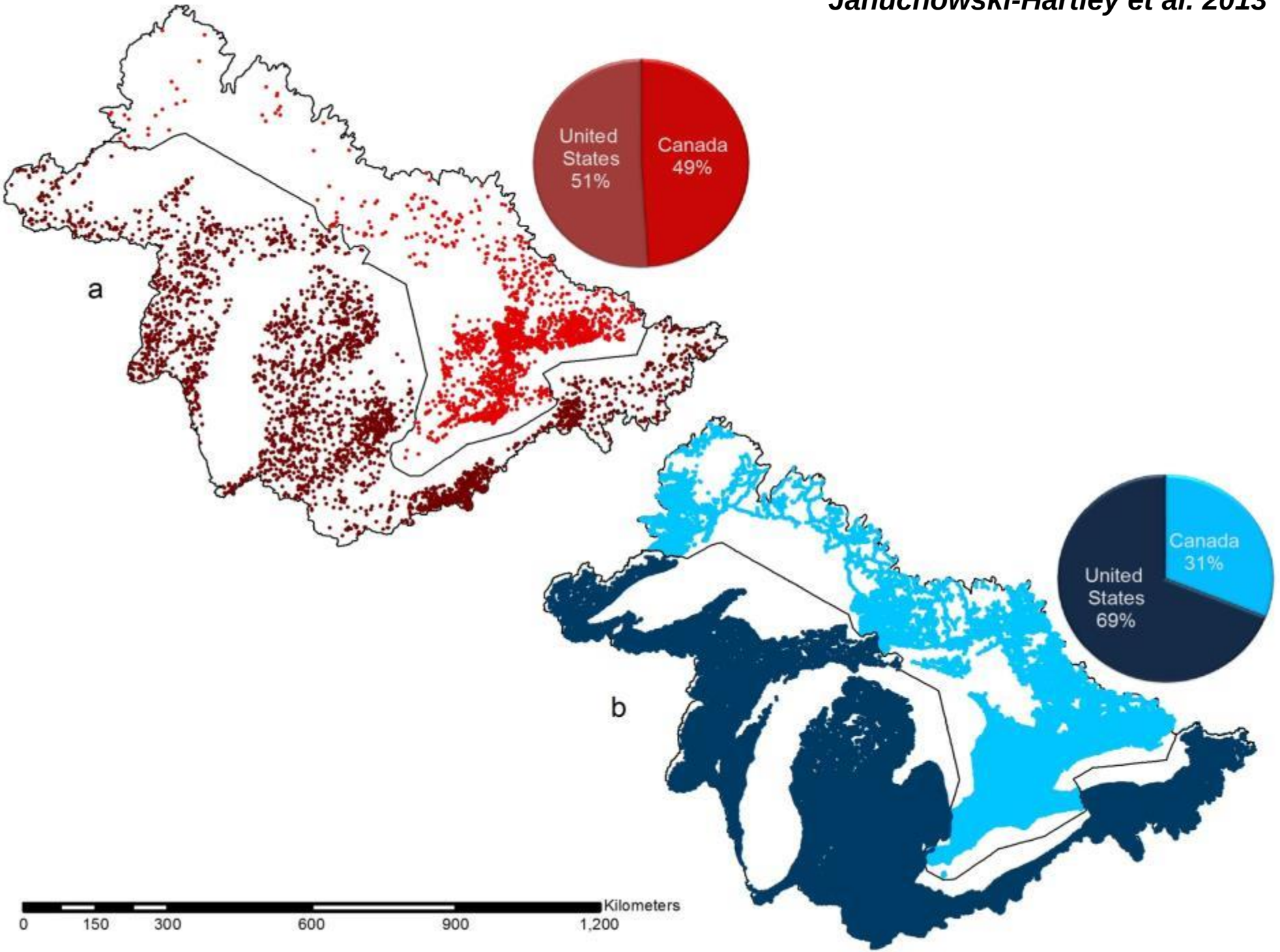
Andrew Muir, Great Lakes Fishery Commission

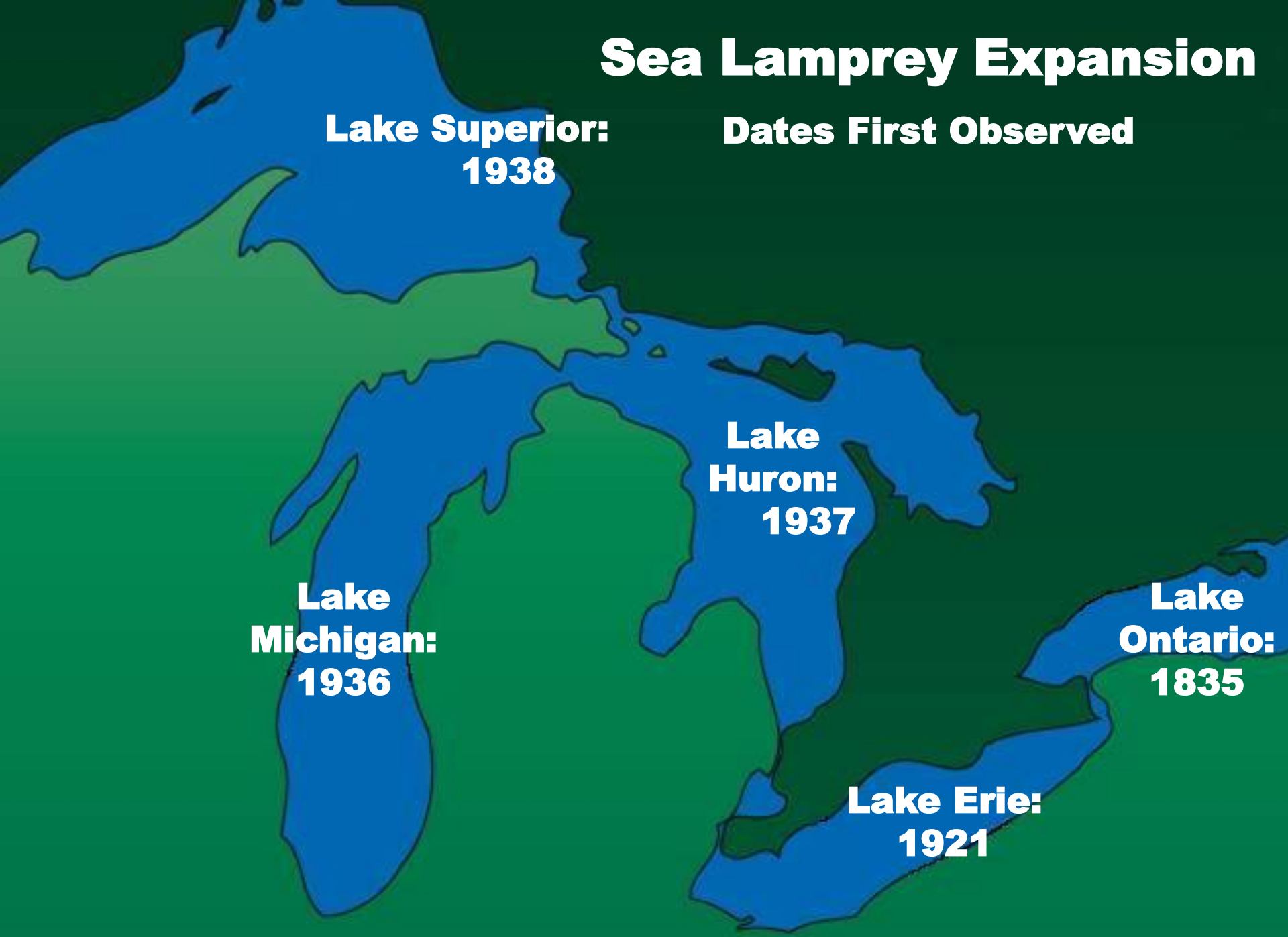


A Brief History of Barriers

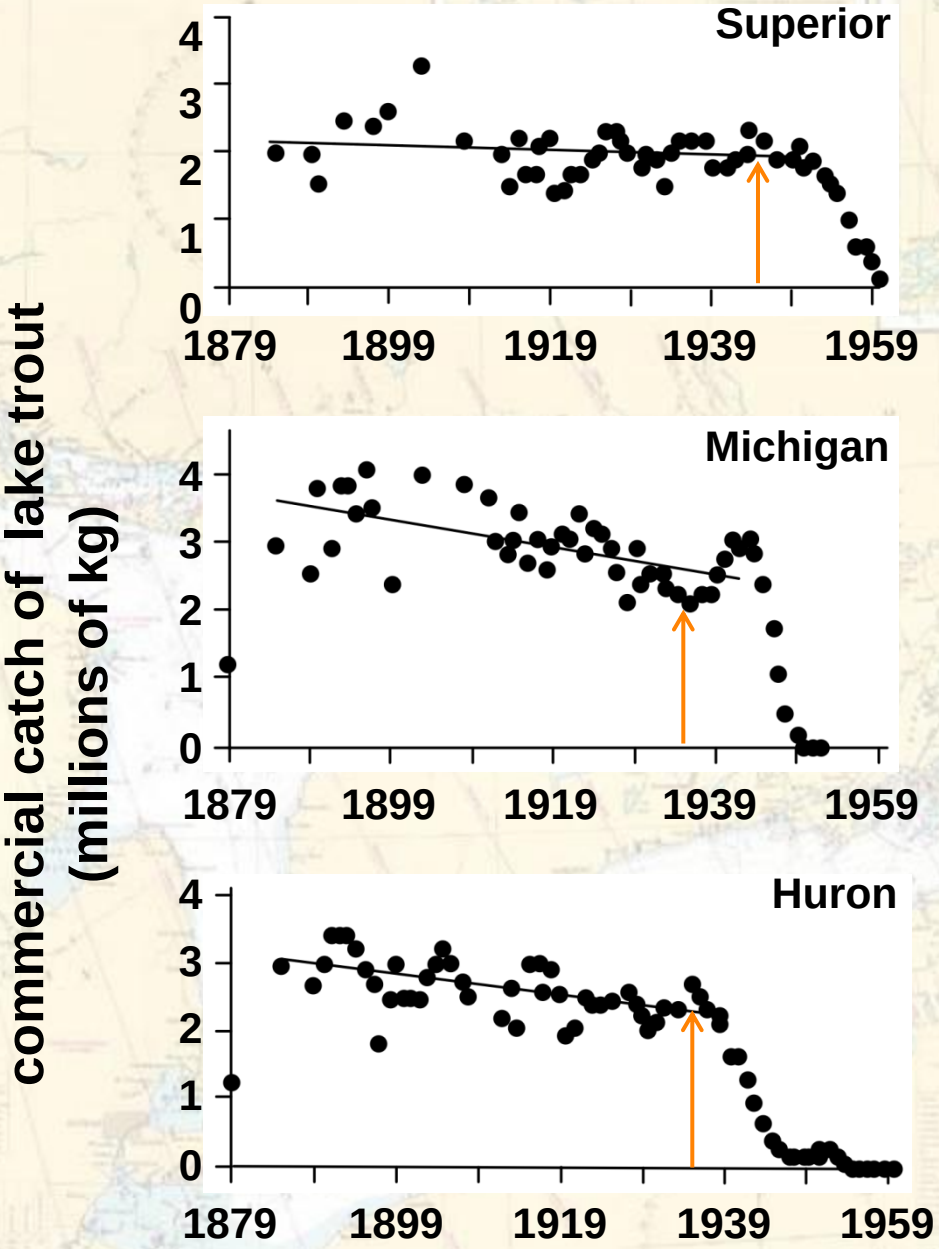
- Milling, mining and forestry
- Water regulation, recreation and hydroelectric power generation
- Control of invasive species

Januchowski-Hartley et al. 2013



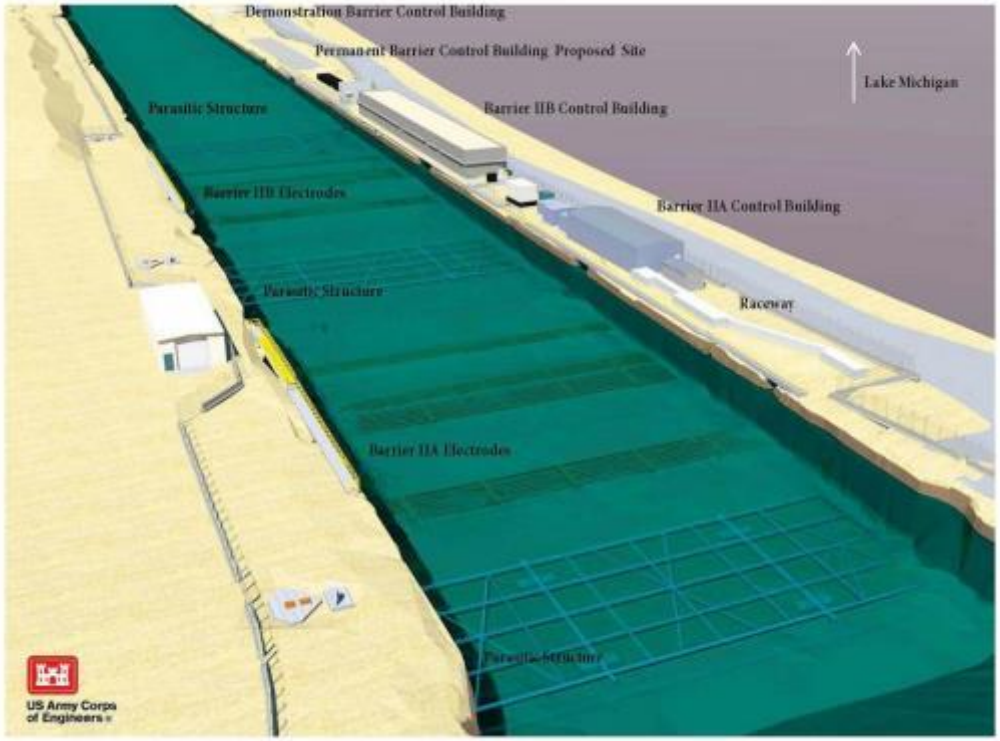

Sea Lamprey Expansion
Dates First Observed
Lake Superior:
1938
Lake
Huron:
1937
Lake
Michigan:
1936
Lake
Ontario:
1835
Lake Erie:
1921

- Sea lampreys helped decimate Great Lakes fish populations
- Barriers are an integral component of a $21MM annual binational sea lamprey control effort



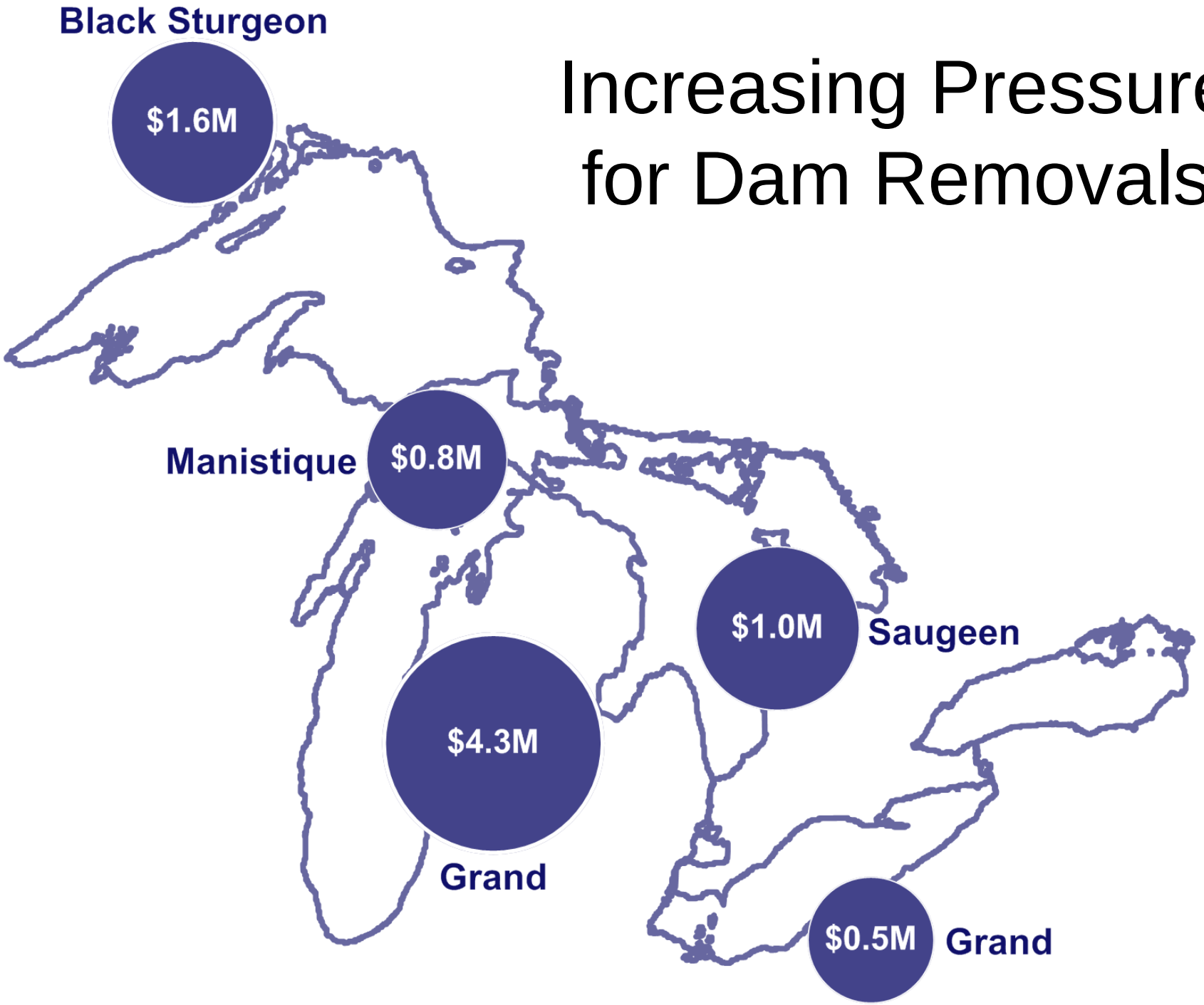
Hansen, M.J. 1999. Great Lakes Fishery Policy and Management - a Binational Perspective.

Asian Carp on the Horizon



- Electrical barrier keeping Asian carp out of the Great Lakes

Increasing Pressure for Dam Removals



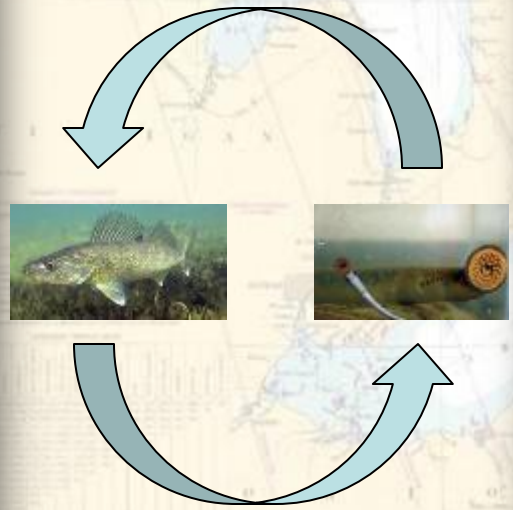
Management Challenge

INVASIVE CONTROL vs RESTORATION

FRAGMENTATION vs CONNECTIVITY

Research Goal

- Provide <u>bi-directional movement</u> of desirable fishes through and <u>removal</u> of invasive fishes in fragmented watersheds



Project Objectives

1. Develop selective bi-directional fish sorting technology as an adaptive management experiment
2. Determine protocols for implementing bi-directional selective fish passage throughout the Great Lakes Basin
3. Set solutions in a global context

How to sort an assortment of things?

HOW IT WORKS

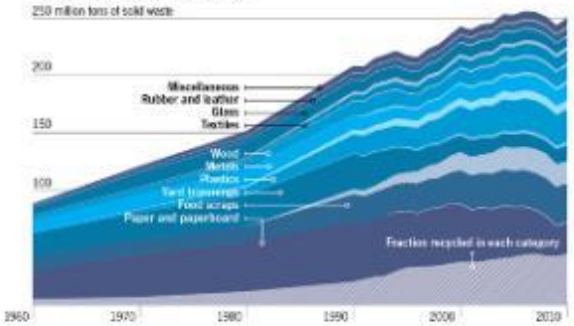
STORY BY KATIE PEEK | ILLUSTRATION BY GRAHAM MURDOCH

SINGLE-STREAM RECYCLING

The most annoying aspect of recycling—and one of the biggest hurdles to its widespread adoption—is having to separate paper, glass, and plastic before they hit the curb. New recycling machines are changing that. With single-stream recycling, recyclables go into one bin, which a truck delivers to a materials-recovery facility, such as Willimantic Waste Paper in Willimantic, Connecticut. There, a largely automated system of conveyor belts, screens, magnets, and lasers separates materials so that they can be sold to metal and plastic recyclers and paper mills.

Of the 570 recycling facilities in the U.S., 240 now have single-stream operations, according to Eileen Berenyi, of the solid-waste research-and-consulting firm Governmental Advisory Associates. While the system isn't perfect—its high-speed operation can lead to contamination from broken glass—the simplicity of it means households actually recycle more. "If people want a higher recycling rate, it has to be convenient," says Chaz Miller, of the National Solid Wastes Management Association. "And I think the technology is only going to improve."

Recycling Rates in the U.S.



STATS

2.4
Tons of carbon dioxide kept out of the atmosphere per ton of solid waste recycled, whether by single-stream or otherwise

One third
Fraction of municipal solid waste in the U.S. that's currently recycled

100 million
Number of U.S. residents served by single-stream recycling programs

92
Percentage recycling rates increased when Florida's Miami-Dade County implemented single-stream recycling in 2008

1 Tipping Floor
2 Drum Feeder
3 Initial Sorters
4 Large Star Screens
5 Second Sorters
6 Medium Star Screens
7 Glass Sorter
8 Magnetic Metal Sorter
9 Eddy Current Separator
10 Infrared lasers
11 Baler
12 Landfill

Aug 2013 Popular Science

Integrating Technologies

Electr

Chemical repellants

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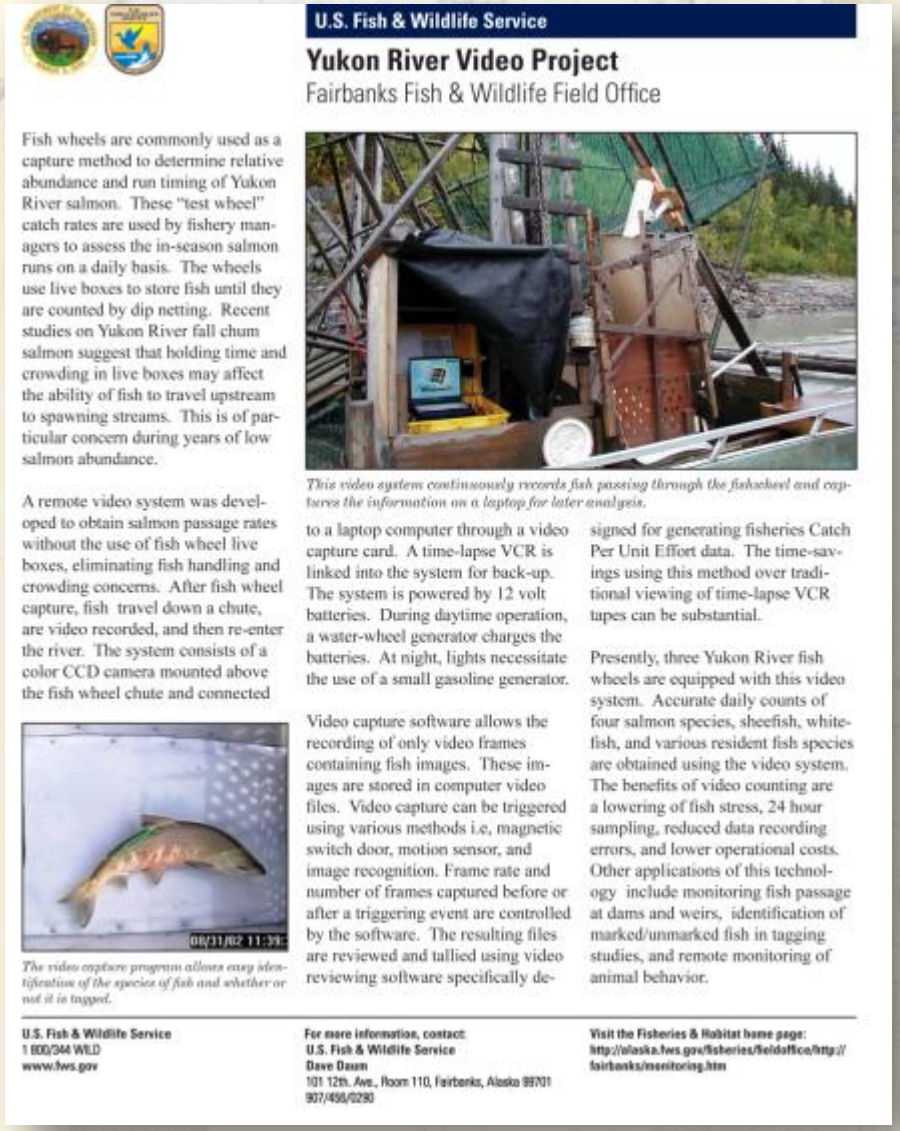
Integrating Technologies



U.S. Fish & Wildlife Service

Yukon River Video Project

Fairbanks Fish & Wildlife Field Office

Fish wheels are commonly used as a capture method to determine relative abundance and run timing of Yukon River salmon. These "test wheel" catch rates are used by fishery managers to assess the in-season salmon runs on a daily basis. The wheels use live boxes to store fish until they are counted by dip netting. Recent studies on Yukon River fall chum salmon suggest that holding time and crowding in live boxes may affect the ability of fish to travel upstream to spawning streams. This is of particular concern during years of low salmon abundance.

A remote video system was developed to obtain salmon passage rates without the use of fish wheel live boxes, eliminating fish handling and crowding concerns. After fish wheel capture, fish travel down a chute, are video recorded, and then re-enter the river. The system consists of a color CCD camera mounted above the fish wheel chute and connected to a laptop computer through a video capture card. A time-lapse VCR is linked into the system for back-up. The system is powered by 12 volt batteries. During daytime operation, a water-wheel generator charges the batteries. At night, lights necessitate the use of a small gasoline generator.

This video system continuously records fish passing through the fishwheel and captures the information on a laptop for later analysis.

Video capture software allows the recording of only video frames containing fish images. These images are stored in computer video files. Video capture can be triggered using various methods i.e, magnetic switch door, motion sensor, and image recognition. Frame rate and number of frames captured before or after a triggering event are controlled by the software. The resulting files are reviewed and tallied using video reviewing software specifically designed for generating fisheries Catch Per Unit Effort data. The time-savings using this method over traditional viewing of time-lapse VCR tapes can be substantial.

Presently, three Yukon River fish wheels are equipped with this video system. Accurate daily counts of four salmon species, sheefish, whitefish, and various resident fish species are obtained using the video system. The benefits of video counting are a lowering of fish stress, 24 hour sampling, reduced data recording errors, and lower operational costs. Other applications of this technology include monitoring fish passage at dams and weirs, identification of marked/unmarked fish in tagging studies, and remote monitoring of animal behavior.

The video capture program allows easy identification of the species of fish and whether or not it is tagged.

U.S. Fish & Wildlife Service
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www.fws.gov

For more information, contact:
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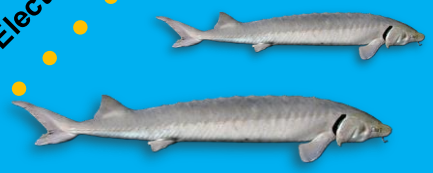
Visit the Fisheries & Habitat home page:
http://alaska.fws.gov/fisheries/fieldoffice/http://fairbanks/monitoring.htm

- **Shape recognition**
- **Behavioral recognition**
- **Color identification**
- **Enumeration**

Conceptual Approach Integrating Technologies

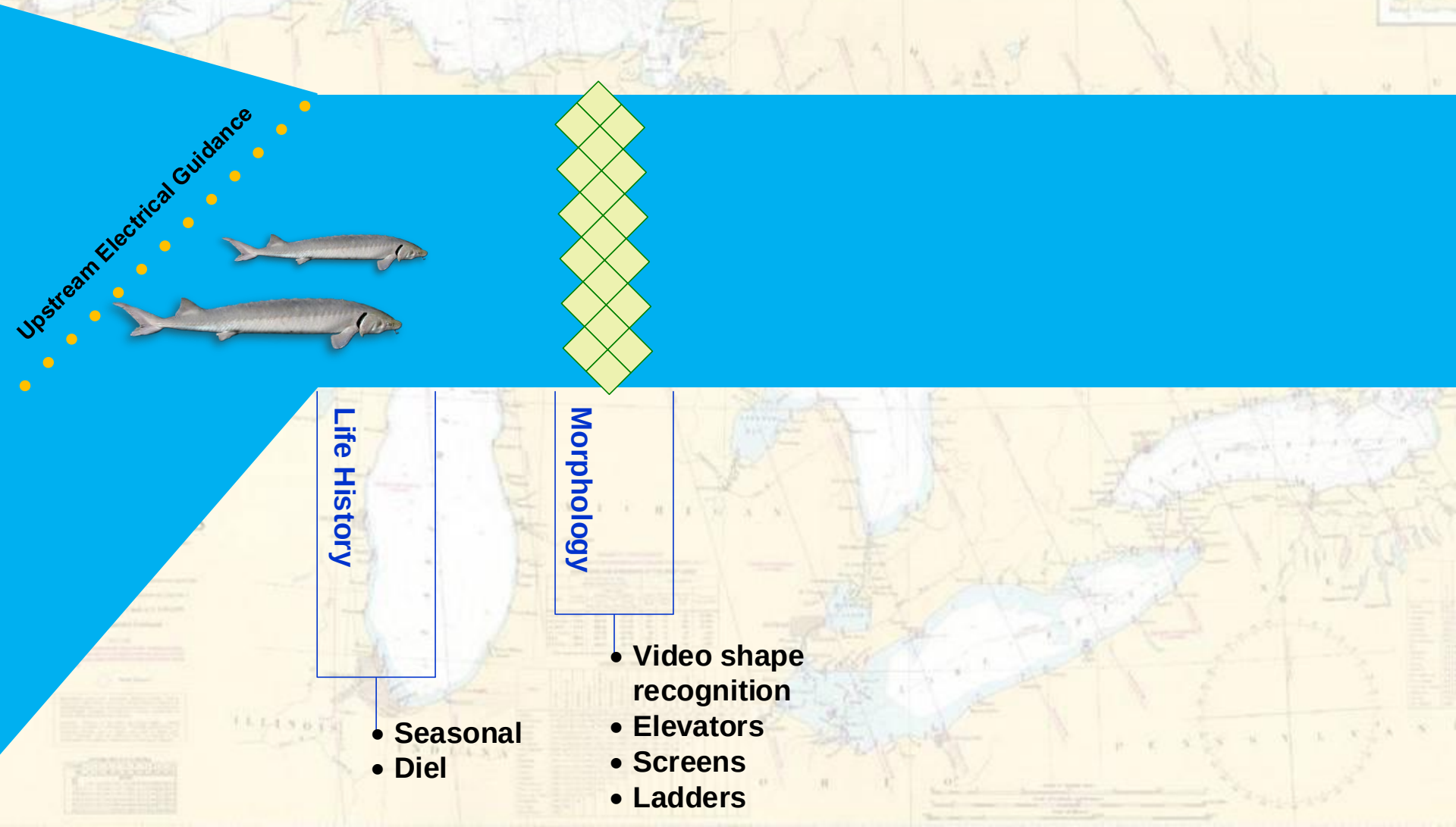
Upstream Electrical Guidance



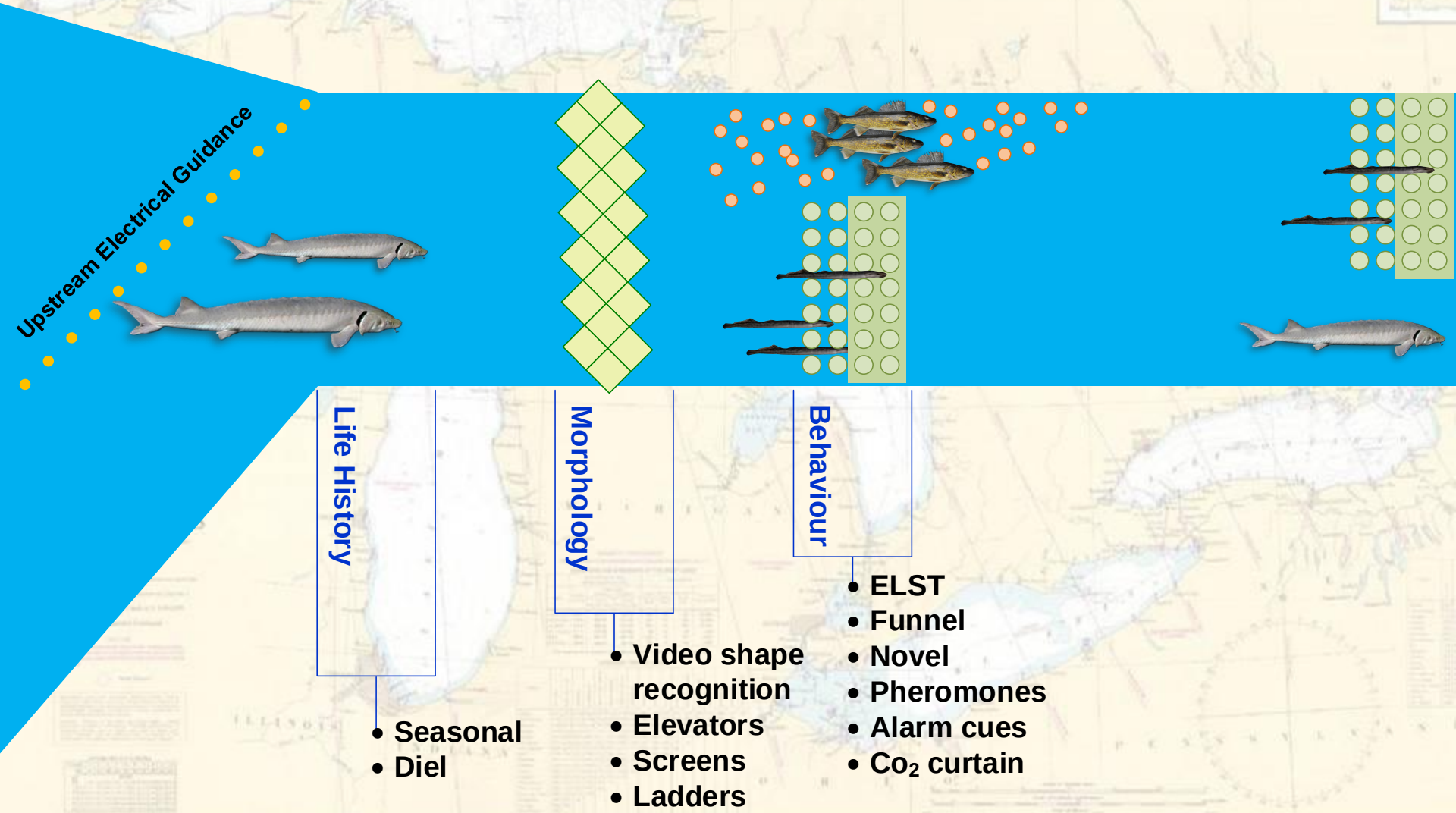
Life History

- Seasonal
- Diel

Conceptual Approach Integrating Technologies



Conceptual Approach Integrating Technologies



- If you have any experience in this area (or ideas) we would love to hear from you:

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KEEP CALM BECAUSE WE NEED YOUR HELP!